A neural prosthesis using the parietal reach region

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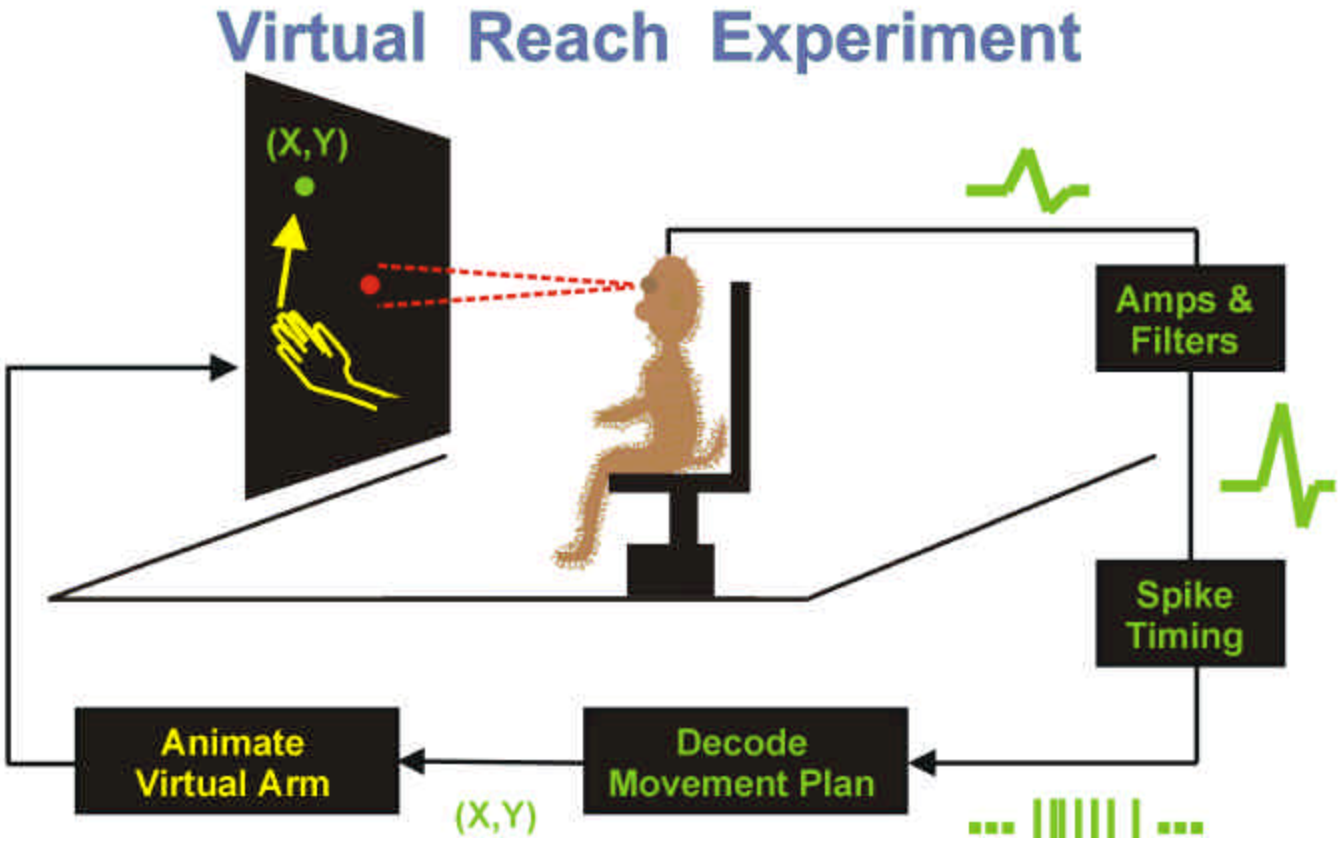
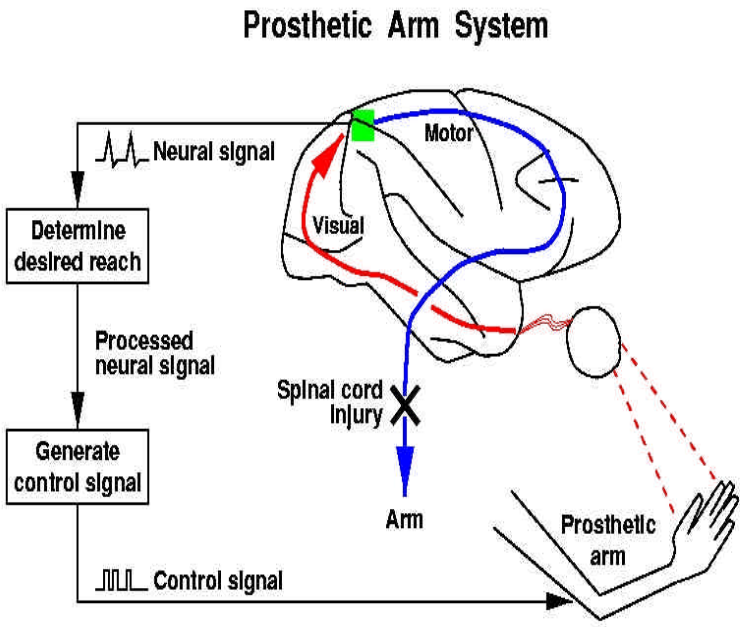
- Biology: to read out thoughts for limb movements in monkeys.
- Informatics: to decode neural signals to estimate desired reaches.
- Informatics: to use these signals to operate a robot limb.
- Microelectronics: to develop an implantable chip for recording and transmitting neural signals.

We will record the intended movement activity from a reach area in the parietal cortex, decode this signal, and use it to move an animated limb on a computer screen, and later a robot limb.

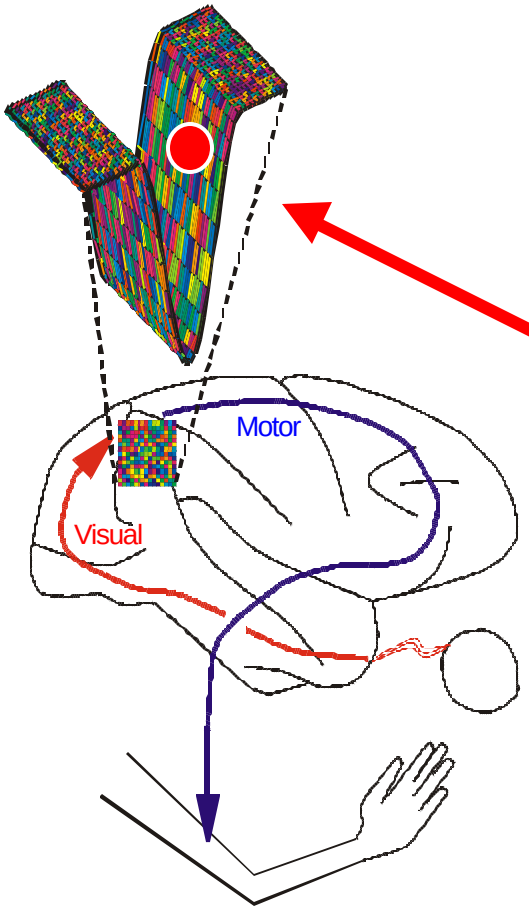


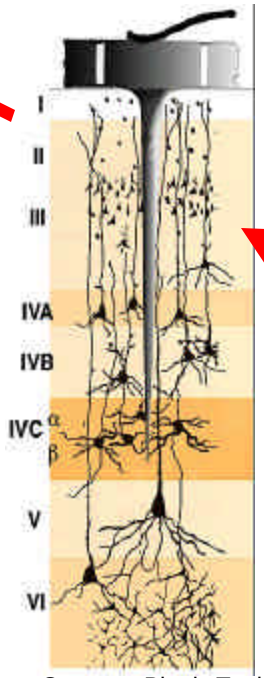
Using the parietal cortex rather than motor cortex is novel. Useful features of parietal cortex activity are:



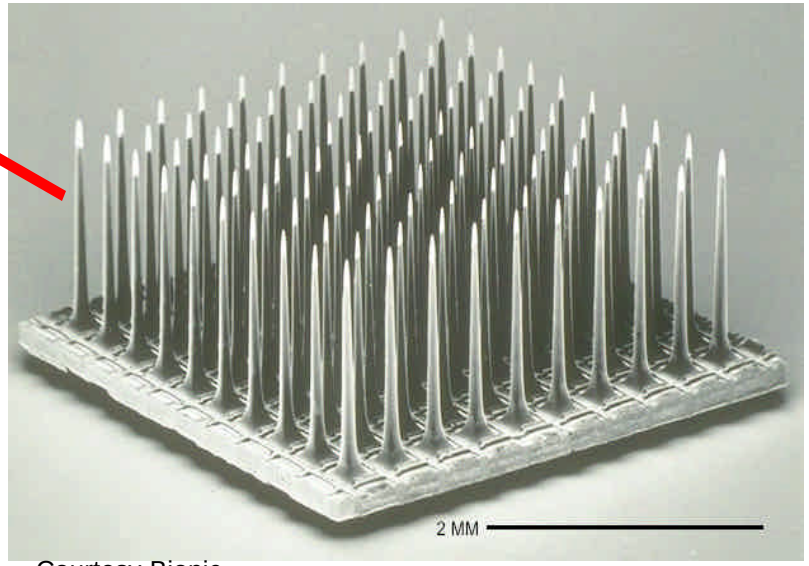
- High level (cognitive) and may require fewer recordings to read out intentions.
- Visual and may show less degeneration or reorganization after spinal cord lesion.
- Plasticity, making it easier to adapt to the implant
- Spatially tuned local field potentials (LFP), which are easier to record than single cells.

Recording from PRR: Chronic Electrode Array



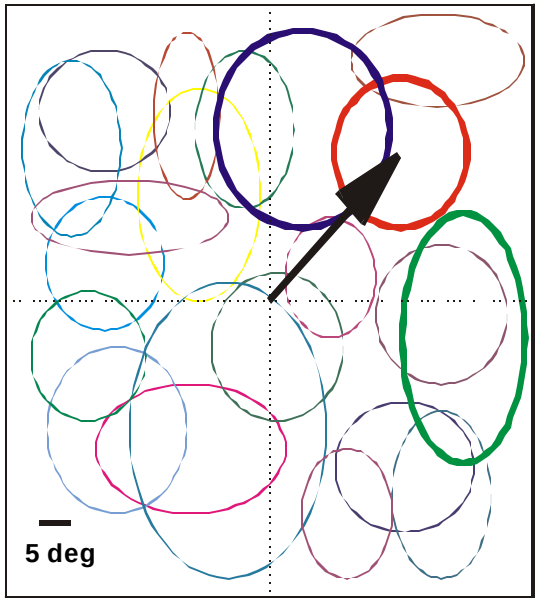


Courtesy Bionic Tech.

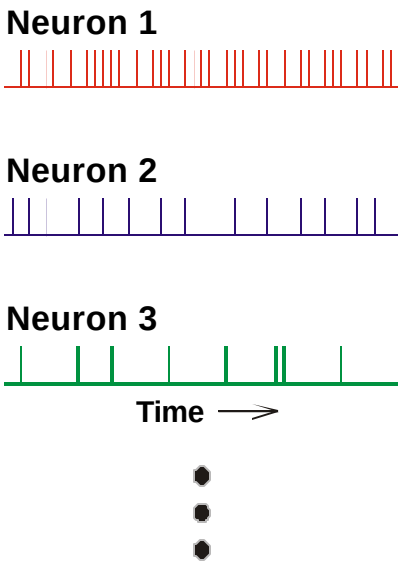


Courtesy Bionic Tech.

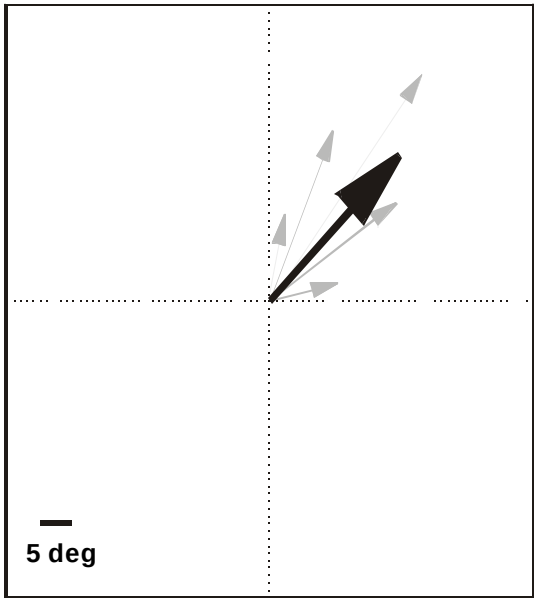
Estimating a Reach from PRR Activity



Characterize receptive fields

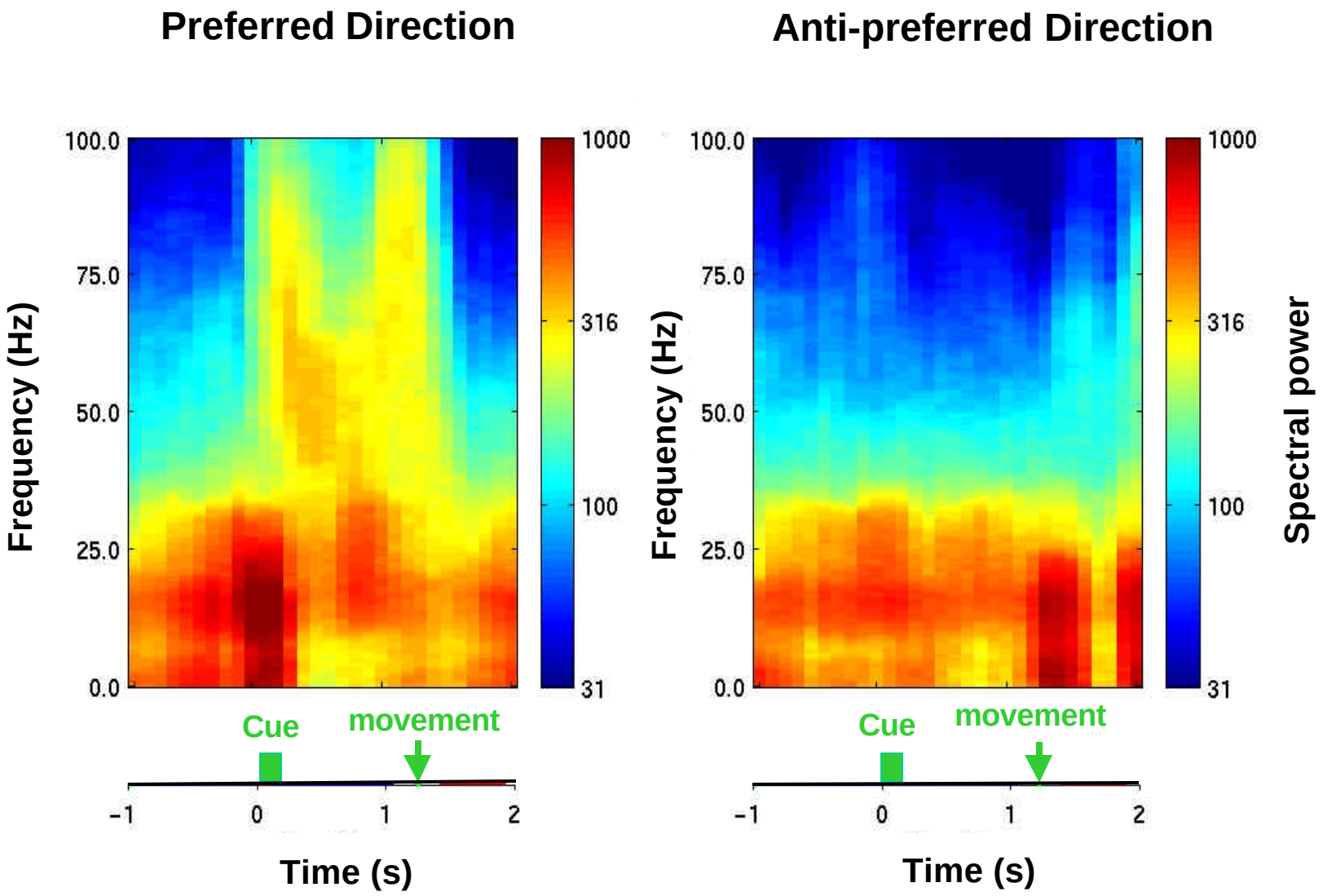


For a single trial, record activity from each cell

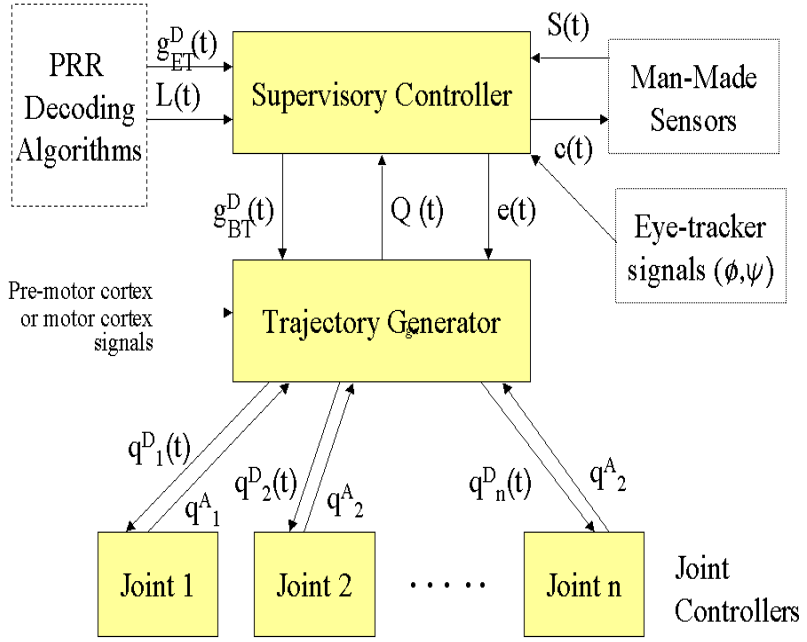


Predict the movement the animal plans to make

The local-field-potential gamma band oscillations are tuned to the directions of planned movement



Robotic control system



- **Develop supervisory controller that takes in cognitive signals.**
- **Tailor controller to interface with the brain.**

Novel technologies and applications that may result

- The population decode algorithms may also be applied to **decision making** in complex, real world situations.
- These studies will result in the design of hybrid, supervisory control systems for **“cognitive” robots**.
- These studies will facilitate development of a **miniaturized, implantable** recording system.
- **Neural prosthetics** will be developed that may help paralyzed patients.